# Positive and negative schizotypy are associated with prodromal and schizophrenia-spectrum symptoms.

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## Abstract:

The present study examined the validity of psychometrically assessed positive and negative schizotypy in a study of 214 Spanish young adults using interview and questionnaire measures of impairment and psychopathology. Schizotypy provides a useful construct for understanding the etiology and development of schizophrenia and related disorders. Recent interview, laboratory, and experience sampling studies have supported the validity of psychometrically assessed positive and negative symptom dimensions. The present study expands on previous findings by examining the validity of these dimensions in a Spanish sample and employing a widely used interview measure of the schizophrenia prodrome. As hypothesized, the positive schizotypy dimension predicted CAARMS ultra high-risk or psychosis threshold status, and both dimensions uniquely predicted the presence of schizophrenia-spectrum personality disorders. Furthermore, positive schizotypy was associated with psychotic-like, paranoid, schizotypal, and mood symptoms, whereas negative schizotypy was associated with interview ratings of negative and schizoid symptoms. The schizotypy dimensions were also distinguished by their associations with self and other schemas. Positive schizotypy was associated with increased negative self and other schemas, whereas negative schizotypy was associated with decreased positive self and other schemas. The findings provide further construct validation of positive and negative schizotypy and support these dimensions as universal constructs.

**Keywords:** schizotypy | schizophrenia | prodrome | dimension | psychology

## Article:

1. Introduction

Recent conceptualizations indicate that the underlying vulnerability for schizophrenia is expressed across a dynamic continuum of symptoms and impairment referred to as schizotypy (e.g., Claridge, 1997, Lenzenweger, 2010 and Kwapil and Barrantes-Vidal, 2012). Rather than viewing schizotypy and schizophrenia as qualitatively distinct, schizophrenia, related spectrum disorders, and the prodrome represent the most extreme manifestations of the schizotypy continuum. The reliable assessment of schizotypy should enhance identification of relevant etiological factors and endophenotypes, facilitate understanding of developmental trajectories (including risk and protective factors), and is essential for developing prophylactic interventions.

Schizotypy, and by extension schizophrenia, is conceptualized as multidimensional, with positive and negative schizotypy the most consistently replicated factors. Positive schizotypy is characterized by odd beliefs, unusual perceptual experiences, negative affect, and affective dysregulation, whereas negative schizotypy involves avolition, asociality, diminished positive affect, and anergia (e.g., Vollema and van den Bosch, 1995). The conceptualization and measurement of schizotypy and schizophrenia as multidimensional are essential for advancing our understanding of these constructs. Studies that treat them as homogenous often produce mixed, equivocal, or non-replicable results because these dimensions are associated with distinct etiologies, presentations, and treatment responses.

The psychometric assessment of schizotypy offers unique benefits such as being relatively inexpensive, noninvasive, and useful for screening large samples of the general population, as well as clinical samples (Kwapil et al., 2008). The Wisconsin Schizotypy Scales (WSS), including the Perceptual Aberration (Chapman et al., 1978), Magical Ideation (Eckblad and Chapman, 1983), Physical Anhedonia (Chapman et al., 1976), and Revised Social Anhedonia (Eckblad et al., 1982) Scales, are widely used, exhibit sound psychometric properties, and are associated cross-sectionally with schizophrenic-like symptoms and impairment, and longitudinally with development of schizophrenia-spectrum disorders (Chapman et al., 1994, Kwapil, 1998 and Gooding et al., 2005).

Kwapil et al. (2008) conducted a series of confirmatory factor analyses to investigate the dimensional structure of the WSS and found support for a hypothesized two-factor model with positive and negative schizotypy dimensions that was invariant across gender and ethnicity. Preliminary construct validity for these dimensions was demonstrated through differential patterns of associations with psychopathology, personality, and impairment. As hypothesized, positive but not negative schizotypy was associated with psychotic-like experiences, substance abuse, mood disorders, and mental health treatment, whereas negative schizotypy was uniquely related to interview-based ratings of negative and schizoid symptoms. Both dimensions were

associated with schizotypal and paranoid symptoms, and impairment in functioning. However, the study did not include criteria assessing prodromal symptoms or classifications.

Schizotypy and schizophrenia are presumed to be universal constructs; therefore Kwapil et al. (2012c) examined the factor invariance of the WSS in Spanish and American samples. As hypothesized, positive and negative schizotypy factors provided the best fit and this structure was invariant across the samples, consistent with findings in a Spanish sample by Fonseca-Pedrero et al. (2010), and supporting previous evidence of the cross-cultural consistency of schizotypy dimensions (Chen et al., 1997 and Reynolds et al., 2000). However, studies assessing the cross-cultural construct validity of these dimensions are needed.

### 1.1. Goals and hypotheses of the present study

The primary goal of the present study was to examine the validity of psychometrically assessed positive and negative schizotypy in a non-clinically ascertained sample of young adults. The study sought to replicate findings that positive and negative schizotypy were associated with differential patterns of symptoms and impairment. It also expanded upon earlier studies by employing a measure of the schizophrenia prodrome, assessing a broader range of personality disorders, increasing assessment of affective symptoms, and including measures of self and other schemas and self-esteem. Both cognitive models of psychosis (e.g., Garety et al., 2007) and empirical evidence (Fowler et al., 2012 and Stowkowy and Addington, 2012) implicate maladaptive schemas in the development and maintenance of psychotic symptoms. Furthermore, the study sought to examine the cross-cultural validity of the schizotypy dimensions by assessing a Spanish sample.

It was hypothesized that both schizotypy dimensions would be associated with schizotypal, paranoid, and avoidant personality traits, suspiciousness, and impaired functioning. Positive schizotypy was expected to be associated with psychotic-like symptoms and measures assessing negative affect, including anxiety, depression, borderline personality, low self-esteem, and negative schemas. In contrast, it was predicted that negative schizotypy would be associated with schizoid and negative symptoms, emotional blunting, and less positive views of self and others.

## 2. Methods

### 2.1. Participants

The present study is part of an ongoing longitudinal project examining risk for psychosis. The participants were drawn from a screening sample of 589 undergraduates at the Universitat Autónoma de Barcelona. Usable screening data was obtained from 547 participants (42 were excluded due to invalid protocols). The mean age was 20.6 years (SD = 4.1) and 83% were female. A subset of 339 participants was invited to take part in an assessment including self-report, interview, and laboratory measures with the goal of assessing 200 individuals. We invited all 189 who had standard scores based upon sample norms of at least 1.0 on the positive or negative schizotypy dimension, the suspiciousness subscale of the Schizotypal Personality Questionnaire (SPQ; Raine, 1991), or the positive symptom subscale of the Community Assessment of Psychic Experiences (CAPE; Stefanis et al., 2002), and 150 randomly selected participants who had standard scores < 1.0 on each of these measures. The goal of the enrichment procedure was to ensure adequate representation of schizotypy in the sample. A total of 214 participants (78% females) with a mean age of 21.4 years (SD = 2.4) completed the assessment. The sample included 123 participants with elevated schizotypy scores and 91 with standard scores below 1.0. Note that the four scales contributed approximately equal numbers of participants with elevated z-scores (ranging from 50 with elevated scores on WSS positive schizotypy to 57 with elevations on the SPQ suspiciousness).

### 2.2. Materials and procedure

At the initial assessment, students completed a battery of self-report measures. At the second assessment, participants were administered diagnostic interviews and questionnaires (along with measures not used in this study). The interviews were conducted by psychologists and advanced graduate students in clinical psychology. All interviewers were extensively trained and were unaware of participants' scores on the screening questionnaires. Individuals were paid for their participation. Ethical approval for the study was granted by the University Ethics Committee and participants provided informed consent at both assessments.

#### 2.2.1. Time 1 measures

Participants were administered the WSS intermixed with an infrequency scale (Chapman and Chapman, 1983). The Perceptual Aberration Scale assesses psychotic-like bodily distortions and perceptual experiences, the Magical Ideation Scale taps belief in invalid causation, the Revised Social Anhedonia Scale measures schizoid asociality, and the Physical Anhedonia Scale assesses deficits in sensory and esthetic pleasure. The Spanish adaptation of the WSS was used (Ros-Morente et al., 2010), which has shown good reliability in college samples and external validity (e.g., Barrantes-Vidal et al., 2003). Participants were assigned positive and negative schizotypy factor scores based upon norms from 6137 American young adults (Kwapil et al., 2008). Note that Kwapil et al. (2012c) demonstrated that the positive and negative schizotypy factor structure

underlying the scales was invariant in Spanish and American samples. Furthermore, the norm-based factor scores correlated .99 with factor scores generated from a principal components analysis with the Spanish sample of 547.

Participants completed the CAPE, which measures positive, negative, and depressive symptoms, as well as the suspiciousness subscale of the SPQ. The depression and anxiety subscales of the Symptom Checklist-90-Revised (SCL-90-R; Derogatis, 1977) were used to assess emotional state. Beliefs about the self and others were evaluated with the Brief Core Schema Scales (BCSS; Fowler et al., 2006), which yields subscale scores for negative-self, positive-self, negative-others, and positive-others. Participants took 1.5 to 2 h to complete the time 1 assessment.

#### 2.2.2. Time 2 measures

The Comprehensive Assessment of At-Risk Mental States (CAARMS; Yung et al., 2005) is a structured interview that assesses the psychosis prodrome. Severity scores for seven CAARMS subscales were used. The CAARMS was also used to assess criteria for ultra high-risk status. The Structured Clinical Interview for DSM-IV Axis II Disorders (First et al., 1997) was used to assess schizophrenia-spectrum personality disorders and provide dimensional ratings. Depression was assessed with the Calgary Depression Scale (Addington et al., 1992) and the Beck Depression Inventory-II (Beck et al., 1996) and self-esteem with the Rosenberg Self-Esteem Scale (Rosenberg, 1965). Functioning was rated using the Social and Occupational Functioning Assessment Scale (Goldman et al., 1992) and the Global Assessment of Functioning (American Psychiatric Association, 2000). Participants took 1.5 to 3 h to complete the time 2 assessment.

## 3. Results

### 3.1. Descriptive statistics

The mean for positive schizotypy was − .31 (SD = .89, range = − 1.56 to 3.23) and for negative schizotypy was .01 (SD = 1.05, range = − 1.57 to 4.27). Both dimensions were unimodal and positively skewed. The schizotypy dimensions were not significantly correlated (r = .11). Descriptive statistics for quantitative criteria measures are presented in Table 1.

Table 1. Descriptive statistics for quantitative dependent measures of symptoms, impairment, and personality.

| Measure | Mean | SD | Range | Alpha[a] |
|---|---|---|---|---|
| CAPE positive symptoms | 8.39 | 4.84 | 0–23 | .76 |
| CAPE negative symptoms | 10.59 | 5.80 | 0–35 | .83 |
| SPQ suspiciousness | 2.97 | 2.05 | 0–8 | .71 |
| CAARMS positive symptoms | 1.21 | 2.69 | 0–24 | – |
| CAARMS negative symptoms | 1.51 | 2.39 | 0–11 | – |
| CAARMS cognitive symptoms | 0.91 | 1.50 | 0–8 | – |
| CAARMS emotional disturbance | 0.94 | 1.91 | 0–11 | – |
| CAARMS behavioral symptoms | 1.36 | 2.05 | 0–9 | – |
| CAARMS motor symptoms | 1.00 | 1.76 | 0–14 | – |
| CAARMS general psychopathology | 3.69 | 3.85 | 0–21 | – |
| Schizotypal personality rating | 1.00 | 1.93 | 0–13 | – |
| Schizoid personality rating | 0.90 | 1.54 | 0–8 | – |
| Paranoid personality rating | 1.53 | 2.08 | 0–12 | – |
| Avoidant personality rating | 2.11 | 2.82 | 0–14 | – |
| Borderline personality rating | 1.43 | 2.27 | 0–12 | – |
| Social and occupational functioning | 86.5 | 8.4 | 40–100 | – |
| Global assessment of functioning | 85.5 | 10.3 | 51–100 | – |
| Rosenberg total | 23.1 | 4.6 | 3–30 | .87 |
| BCSS negative self | 2.68 | 3.00 | 0–16 | .65 |
| BCSS negative others | 3.20 | 3.53 | 0–17 | .77 |
| BCSS positive self | 12.42 | 4.73 | 2–24 | .81 |

| Measure | Mean | SD | Range | Alpha[a] |
|---|---|---|---|---|
| BCSS positive others | 10.29 | 4.85 | 0–21 | .84 |
| SCL-90-R anxiety | 6.99 | 5.65 | 0–29 | .81 |
| SCL-90-R depression | 12.33 | 8.23 | 0–43 | .86 |
| Calgary depression scale | 1.21 | 2.07 | 0–13 | – |
| Beck depression inventory | 5.33 | 5.33 | 0–29 | .81 |
| CAPE depression | 6.08 | 2.93 | 1–18 | .75 |

a Coefficient alpha reported for questionnaire measures only.

### 3.2. Validity of the schizotypy dimensions

In order to assess the validity of the schizotypy dimensions, a series of hierarchical linear regressions were computed that examined the variance accounted for by positive and negative schizotypy and their interaction in measures of psychopathology, personality, and functioning. Positive and negative schizotypy dimension scores were entered simultaneously in the regression at the first step to examine their unique contribution. The interaction term was entered at the second step to assess its effect over-and-above the main effects. The standardized regression coefficient (β), semi-partial r2, and effect size f2 were reported for each predictor in the linear regressions. According to Cohen (1992), f2 values above .15 are medium and above .35 are large effect sizes (however, note that designs that employ oversampling can lead to inflated estimates of effect sizes). Given that many of the continuous dependent variables were skewed (especially measures of psychopathology), maximum likelihood estimation and bootstrap procedures (with 2000 samples) were employed. Given the large number of linear regressions, alpha level was set at .01 to minimize Type I error and reduce the likelihood of reporting statistically significant but inconsequential findings.

Table 2 presents the results of analyses examining the prediction of schizophrenia-spectrum, prodromal, and personality disorder symptoms. As expected, negative schizotypy was significantly associated with ratings of negative and schizoid symptoms, and with affective flattening. It was also associated with schizotypal and avoidant personality ratings and suspiciousness. Positive schizotypy was significantly associated with all of the outcome measures except for schizoid and motoric symptoms.

Table 2. Linear regressions of questionnaire and interview measures of schizophrenia-spectrum and prodromal symptoms (n = 214).

| | Step 1 (df = 211) | | | | | | Step 2 (df = 210) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Positive schizotypy | | | Negative schizotypy | | | Interaction | | |
| Criterion | β | $\Delta r^2$ | $f^2$ | β | $\Delta r^2$ | $f^2$ | β | $\Delta r^2$ | $f^2$ |
| CAPE positive symptoms | .708□ | .496 | ***.99*** | .001 | .000 | .00 | -.016 | .000 | .00 |
| CAPE negative symptoms | .382□ | .144 | **.22** | .402□ | .160 | **.24** | .089 | .008 | .01 |
| SPQ suspiciousness | .554□ | .304 | ***.50*** | .237□ | .056 | .09 | .021 | .000 | .00 |
| CAARMS positive symptoms | .300□ | .089 | .10 | .166 | .027 | .03 | .089 | .008 | .01 |
| CAARMS negative symptoms | .330□ | .108 | .13 | .195□ | .037 | .05 | .104 | .011 | .01 |
| CAARMS cognitive symptoms | .181□ | .032 | .03 | .136 | .018 | .02 | -.087 | .008 | .01 |
| CAARMS emotional disturbance | .206□ | .042 | .05 | .347□ | .119 | **.15** | .065 | .004 | .01 |
| CAARMS behavioral symptoms | .315□ | .098 | .11 | .149 | .022 | .03 | .066 | .004 | .00 |
| CAARMS motor symptoms | .142 | .020 | .02 | .154 | .024 | .03 | -.057 | .003 | .00 |
| CAARMS general psychopathology | .248□ | .061 | .07 | .189□ | .035 | .04 | .091 | .008 | .01 |
| Schizotypal personality rating | .309□ | .094 | .12 | .285□ | .080 | .10 | .102 | .010 | .01 |
| Schizoid personality rating | .100 | .010 | .01 | .473□ | .221 | **.29** | -.081 | .006 | .01 |
| Paranoid personality rating | .356□ | .125 | **.15** | .145 | .021 | .02 | .135 | .018 | .02 |
| Avoidant personality rating | .322□ | .102 | .12 | .246□ | .060 | .07 | .130 | .017 | .02 |
| Borderline personality rating | .347□ | .119 | .14 | .109 | .012 | .01 | .088 | .008 | .01 |

□ $p < .01$; Medium effect sizes in bold, large effect sizes in bold and italics.

The finding that positive schizotypy was associated with CAPE and CAARMS ratings of negative symptoms is counterintuitive. However, both of these purported measures of negative

symptoms appear to be saturated with depression and positive symptoms. The CAPE negative symptom scale correlated highly with CAPE depression (r = .57), SCL-90 depression (r = .60), and CAPE positive symptoms (r = .41), but only modestly with schizoid personality symptoms (r = .32). Likewise, CAARMS negative symptom ratings correlated higher with CAARMS positive symptoms (r = .51) and depression (r = .46), than with schizoid symptoms (r = .29). As an exploratory analysis, we recomputed the regression predicting CAPE negative symptoms after partialling out CAPE positive and depression symptoms. The association with positive schizotypy was no longer significant, but the association with negative schizotypy remained significant (confirming concerns about the CAPE negative symptom scale). The schizoid dimensional score, which was associated with negative but not positive schizotypy, appears to provide a better measure of negative symptoms than the CAPE or CAARMS.

Table 3 presents the results of analyses assessing functioning, self, and mood. Both schizotypy dimensions were associated with impaired functioning. As hypothesized, positive schizotypy was associated with measures of anxiety and depression. In contrast, negative schizotypy was generally unassociated with anxiety and depression. Likewise, positive schizotypy was associated with low self-esteem and negative schemas of self and others; whereas, negative schizotypy was associated with diminished positive schemas.

Table 3. Linear regressions of interview measures of functioning, self, and mood (n = 214).

| | Step 1 (df = 211) | | | | | | Step 2 (df = 210) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Positive schizotypy | | | Negative schizotypy | | | Interaction | | |
| Criterion | β | $\Delta r^2$ | $f^2$ | β | $\Delta r^2$ | $f^2$ | β | $\Delta r^2$ | $f^2$ |
| Social and occupational functioning | − .247□ | .060 | .07 | − .271□ | .072 | .09 | − .072 | .005 | .01 |
| Global assessment of functioning | − .271□ | .072 | .09 | − .259□ | .066 | .08 | − .035 | .001 | .00 |
| Rosenberg total | − .377□ | .141 | **.17** | − .191□ | .036 | .04 | − .072 | .005 | .01 |
| SCL-90-R anxiety | .507□ | .254 | ***.35*** | .105 | .011 | .02 | .024 | .001 | .00 |
| SCL-90-R depression | .447□ | .198 | **.25** | .183□ | .033 | .04 | .175 | .030 | .04 |
| Calgary depression scale | .201□ | .043 | .04 | .088 | .008 | .01 | .099 | .010 | .01 |
| Beck depression inventory | .344□ | .117 | .14 | .173 | .029 | .03 | .111 | .012 | .01 |
| CAPE depression | .460□ | .210 | **.28** | .163 | .026 | .03 | .189□ | .035 | .05 |
| BCSS negative self | .226□ | .050 | .05 | .174 | .030 | .03 | .154 | .023 | .05 |
| BCSS negative others | .416□ | .171 | **.21** | .053 | .003 | .00 | .033 | .001 | .00 |
| BCSS positive self | − .058 | .003 | .00 | − .357□ | .126 | **.15** | − .027 | .001 | .00 |
| BCSS positive others | − .140 | .019 | .02 | − .405□ | .162 | **.20** | .008 | .000 | .00 |

□ $p < .01$; Medium effect sizes in bold, large effect sizes in bold and italics.

In order to assess the prediction of diagnostic criteria by the schizotypy dimensions, binary logistic regressions were computed. Schizophrenia-spectrum personality disorders were reported

by 10 participants: 5 with Avoidant, 2 with Schizotypal, 4 with Paranoid, and 3 with Borderline Personality Disorders (3 qualified for more than one disorder). Both positive (OR = 1.96, 95%CI = 1.08–3.58) and negative (OR = 1.89, 95%CI = 1.12–3.27) schizotypy significantly predicted schizophrenia-spectrum personality disorders. The interaction term was not significant (OR = 1.00, 95%CI = 0.60–1.65). Note that when we examined the association of the schizotypy dimensions with individual personality disorders, positive schizotypy significantly uniquely predicted schizotypal (OR = 3.43, 95%CI = 1.03–11.50) and paranoid (OR = 2.68, 95%CI = 1.14–6.36) personality disorders. Negative schizotypy predicted avoidant personality disorder (OR = 2.25, 95%CI = 1.13–4.51). Thus, the schizotypy dimensions were associated with quantitative and categorical assessments of personality pathology.

Criteria for CAARMS ultra high-risk status or psychosis threshold were met by 9 of the participants: 2 met vulnerability criteria, 8 met attenuated psychosis criteria, and 1 met psychosis threshold criteria (2 met both vulnerability and attenuated criteria). Positive schizotypy (OR = 2.16, 95%CI = 1.17–4.00) significantly predicted CAARMS prodromal group membership. Neither negative schizotypy (OR = 1.47, 95%CI = 0.82–2.61) nor the schizotypy interaction (OR = 0.76, 95%CI = 0.44–1.31) was significant.

## 4. Discussion

Current approaches to understanding risk for psychopathology conceptualize schizotypy as the expression of underlying developmental vulnerability for schizophrenia. Psychometrically assessed positive and negative schizotypy provide a useful point of entry for understanding developmental trajectories, potential endophenotypes, and risk and protective factors. Further, schizotypy provides a unique framework for identifying points of intervention for preventative treatment. Numerous studies support the multidimensionality of schizophrenia, with positive, negative, and disorganized factors as the leading candidates. Consistent with the model that schizophrenia represents the most extreme manifestation of the schizotypy continuum, schizotypy and schizophrenia exhibit a similar factor structure. However, researchers frequently treat schizophrenia and schizotypy as homogenous constructs, thus ignoring within-group heterogeneity. This practice runs the risk of obscuring true endophenotypes and necessarily falls short in explaining the heterogeneity seen in the etiology, symptom presentation, and treatment responses in schizotypy and schizophrenia. This study provided further evidence for the validity of positive and negative schizotypy as distinct dimensions.

Consistent with previous work (e.g., Kwapil et al., 2008), the negative schizotypy dimension was associated with impaired functioning and with interview-based ratings of negative, schizoid, and

schizotypal symptoms. The present study extended these findings by indicating that negative schizotypy was associated with prodromal measures of emotional disturbance (consistent with reports of affective flattening in daily life by Kwapil et al., 2012a). Positive schizotypy was related to all outcome measures except schizoid and motoric symptoms. This study extended our previous findings by examining the association of the schizotypy dimensions with measures of the schizophrenia prodrome. It is important to keep in mind that positive and negative schizotypy were associated with the hypothesized pattern of symptoms and impairment in a non-clinically ascertained sample. As in Kwapil et al. (2008), positive and negative schizotypy were uniquely associated with schizophrenia-spectrum symptoms, despite the fact that the participants in the study were functioning well enough to enroll in a university.

The finding that the positive and negative schizotypy interaction term generally did not account for additional variance is consistent with our previous studies and suggests that the effects of the dimensions tend to be additive. This additive effect is supported by Barrantes-Vidal et al.'s (2010) findings of marked deviancy for a combined positive and negative schizotypy cluster.

This study was the first to investigate the validity of the positive and negative schizotypy dimensions in a non-North American sample using interview measures. Previous studies have indicated that the two-factor structure underlying the WSS is invariant across Spanish (Kwapil et al., 2012c) and French (Qunbar et al., 2012) samples, and the present findings supported the validity of these dimensions in a Spanish sample. The findings provide evidence that positive and negative schizotypy are global or cross-cultural constructs—although future studies should examine the validity of these dimensions in other cultures and languages.

Consistent with previous findings, positive schizotypy was associated with measures of anxiety and depression, and with low self-esteem and negative schemas. In contrast, negative schizotypy was associated with diminished positive self and other schemas. This pattern of results highlights the differential role of affect, such that positive schizotypy tends to be characterized by affect dysregulation and high negative affect, whereas negative schizotypy is associated with diminished positive affect (Krabbendam et al., 2002, Lewandowski et al., 2006, Barrantes-Vidal et al., 2009 and Armando et al., 2010). This distinction offers insight into the long-term trajectories of the dimensions, such as social anxiety for positive and schizoid withdrawal for negative schizotypy, and also has the potential to isolate specific mechanisms that can be targeted with treatment interventions.

Both positive and negative schizotypy significantly predicted ratings of Avoidant Personality Disorder; however, it appears that distinct mechanisms are involved. Specifically, those with primarily positive features may be more likely to avoid contact with others due to social anxiety, low self-esteem, and social rejection. This is consistent with experience sampling findings that positive schizotypy is associated with a desire to be alone when with others because of anxiety (Kwapil et al., 2012a). Those with negative schizotypy, on the other hand, likely avoid others due to diminished motivation for and pleasure from interacting with others. This is consistent with experience sampling findings that negative schizotypy was associated with a desire to be alone that was moderated by diminished positive affect, not increased negative affect.

The finding that the positive schizotypy dimension was associated with questionnaire (CAPE) and interview (CAARMS) measures of negative symptoms is inconsistent with our previous findings and contrary to our hypotheses. Note that Kwapil et al. (2008) reported that positive schizotypy was not significantly associated with interview-based ratings on the Negative Symptom Manual (Kwapil and Dickerson, 2001) or schizoid symptoms. Furthermore, previous studies using the Perceptual Aberration and Magical Ideation Scales (e.g., Kwapil et al., 2002), which account for the majority of the variance in the positive schizotypy dimension, found that these scales were unassociated with negative or schizoid symptoms. Consistent with previous findings, the positive schizotypy dimension was not associated with schizoid symptoms in the present study. We suggest that the most likely explanation is that the CAPE and CAARMS negative symptom measures do not adequately measure the construct, as evidenced by their high correlations with positive symptoms and depression. Despite the fact that depressive symptoms are more strongly associated with positive schizotypy than with negative schizotypy, negative symptoms and depression share a number of phenomenological similarities. Therefore, it is essential that measures of negative symptoms are not confounded by variance associated with depression or by positive symptoms.

Negative symptoms of schizotypy and schizophrenia involve anhedonia, withdrawal, affective flattening, anergia, avolition, and diminished vitality and cognition. One possible concern about our schizotypy dimension is that it is based on measures of anhedonia and, to a lesser extent, social withdrawal. As a result, it may not fully capture the construct of negative symptoms. However, an increasing number of studies have demonstrated that this dimension is associated with interview ratings of negative and schizoid symptoms, but not depression. These findings provide striking evidence that trait anhedonia is a significant component of negative symptoms of schizotypy and schizophrenia.

The present findings provided further support for the construct validity of the positive and negative schizotypy dimensions. However, several other candidate dimensions have been proposed and require further study including cognitive and behavioral disorganization (Claridge et al., 1996, Reynolds et al., 2000 and Vollema and Hoijtink, 2000), paranoia (Stefanis et al., 2004), and nonconformity (Claridge et al., 1996). The present findings are limited by being cross-sectional. Recent re-evaluation of the Chapmans' ten-year longitudinal study data indicates that the positive schizotypy dimension predicts the development of psychotic disorders, including non-mood and mood psychoses, in a sample of former college students and that both dimensions uniquely predict the development of schizophrenia-spectrum disorders, including Cluster A personality disorders (Kwapil et al., 2012b). Both dimensions were also associated with a differential pattern of impairment and psychotic-like and schizotypic symptoms, consistent with the present findings. We are currently reassessing the present sample to examine the predictive validity of the positive and negative symptom dimensions.

Additional research is needed to address the limitations of the present study. Data from community samples with a representative distribution in terms of age and gender would enhance the generalizability of the current findings, which were based on a relatively high-functioning sample with a predominance of female participants and a narrow age range. However, the fact that the findings drawn from a college student sample supported the hypotheses and mirror those reported in clinical and community populations is especially striking. Future studies should continue to examine the cross-cultural validity of these dimensions in other Western and non-Western cultures and languages to increase our understanding of the universality of these dimensions.

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## Contributors

Neus Barrantes-Vidal, Ph.D., was the principal investigator, designed the study, and contributed to writing of the manuscript.

Georgina M. Gross, M.S., contributed to the writing of the manuscript.

Tamara Sheinbaum, M.S., contributed to data collection, data management, and writing of the manuscript.

Mercè Mitjavila, Ph.D., contributed to data collection and data management.

Sergi Ballespí, Ph.D., contributed to data collection and data management.

Thomas R. Kwapil, PhD, designed the study, conducted the data analyses, and contributed to the writing of the manuscript.

Conflict of interest

None of the authors had a conflict of interest.

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Supplemental Table 1. Pearson Correlations of Predictor and Criterion Measures

| | **(1)** | **(2)** | **(3)** | **(4)** | **(5)** | **(6)** | **(7)** | **(8)** | **(9)** | **(10)** |
|---|---|---|---|---|---|---|---|---|---|---|
| WSS Positive Schizotypy (1) | | .11 | .71*** | .43*** | .58*** | .32*** | .20** | .24*** | .35*** | .33*** |
| WSS Negative Schizotypy (2) | | | .08 | .44*** | .30*** | .20** | .16* | .37*** | .23** | .18** |
| CAPE Positive Symptoms (3) | | | | .41*** | .56*** | .20** | .11 | .15* | .23** | .21** |
| CAPE Negative Symptoms (4) | | | | | .52*** | .30*** | .20** | .32*** | .30*** | .28*** |
| SPQ Suspiciousness (5) | | | | | | .28*** | .20** | .24*** | .27*** | .28*** |
| CAARMS Positive Symptoms (6) | | | | | | | .67*** | .59*** | .50*** | .57*** |
| CAARMS Cognitive Symptoms (7) | | | | | | | | .54*** | .48*** | .49*** |
| CAARMS Emotional Symptoms (8) | | | | | | | | | .59*** | .61*** |
| CAARMS Negative Symptoms (9) | | | | | | | | | | .69*** |
| CAARMS Behavioral Symptoms (10) | | | | | | | | | | |